Research Note 86-06

THE COMPUTER-AIDED ANALYTIC PROCESS MODEL:

OPERATIONS HANDBOOK FOR THE ANALYTIC PROCESS MODEL DEMONSTRATION PACKAGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Computer-Aided APM demonstration provides the analyst with the opportunity to perform a thorough analysis of a system, while the computer keeps track of the analysis, and insures that the analyst examines the parts of the data base which are of interest. This is, however, a demonstration package which can only process small data bases. Because the package is implemented on an Apple II Plus, processing is relatively slow. An explanation of the APM listings of data sets derived using the APM and reccommendations for further development of the APM model appear in the (cont)

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item 20. Abstract - continued

companion volume-- "The Analytic Process Model for System Design and Measurement: A Computer-Aided Tool for Analyzing Training Systems and Other Human-Machine Systems."

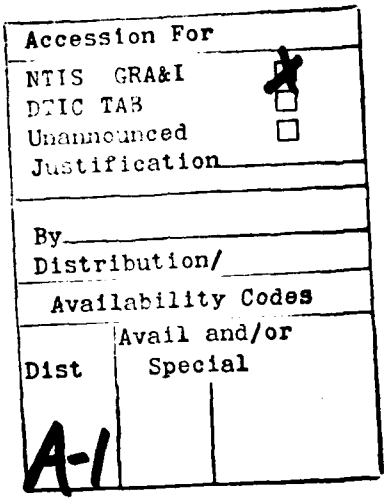

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TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

This report is a supporting document to the Final Summary Report* on an analytic process model (APM) for systems design and measurement. The present document contains the operating information for the computer-aided version of the APM, which was developed for the Army Research Institute (ARI) Field Unit, Fort Benning, over the period from March 1980 to February 1983.

The objective of the computer-aided APM is to provide a routinized, thorough, adaptive and efficient procedure to help testers, analysts and researchers develop design specifications and evaluation measures for any planned or existing human-machine system, and especially for any training system. The demonstration version of the computer-aided model, as described in this report, performs a sample of the routines expected in any ultimate version that may be developed in the future. Specifically, the demonstration model helps one to derive evaluation measures, but not design specifications. In addition, it contains data bases for training systems, but not for any other human-machine system. Finally, it contains data bases for only half of the six training subsystems (for design, enabling and delivery, but not for command, logistics or emplacement). For demonstration purposes, this development represents an appropriate and sufficient allocation of project resources, since the more significant effort was needed to develop the underlying concepts for both a feasible "manual" model and the computer-aided model. The demonstration model, using an Apple II Plus computer with two 5¼-inch disk drives, programmed in PASCAL, can be exercised straight through, beginning with identifying the system and ending with a subset of its performance measures. Any larger capability than presently exists in the demonstration routine would require a computer with substantially greater capacity and speed.

Figure 1 illustrates the overall APM for system design and evaluation. The computer-aided demonstration routine leads the analyst through Blocks 1, 2 and 4, for a portion of a training system. The ultimate model would include Block 3 and would contain data bases to guide the analyst completely through other types of systems as well as a complete training system.

This report is designed as an operations handbook for the demonstration package of the computer-aided APM. It therefore contains item-by-item directions for starting up and carrying out all the steps in the demonstration routine, schematic flow charts and miscellaneous information about the equipment and maintenance.

*Bloom, R.F., Oates, J.F., Jr., Shapiro, R.G. and Hamilton, J.W. The Analytic Process Model for System Design and Measurement: A Computer-Aided Tool for Analyzing Training Systems and Other Human-Machine Systems. Norwalk, CT: Dunlap and Associates East, Inc., 28 February 1983. (Final Summary Report)

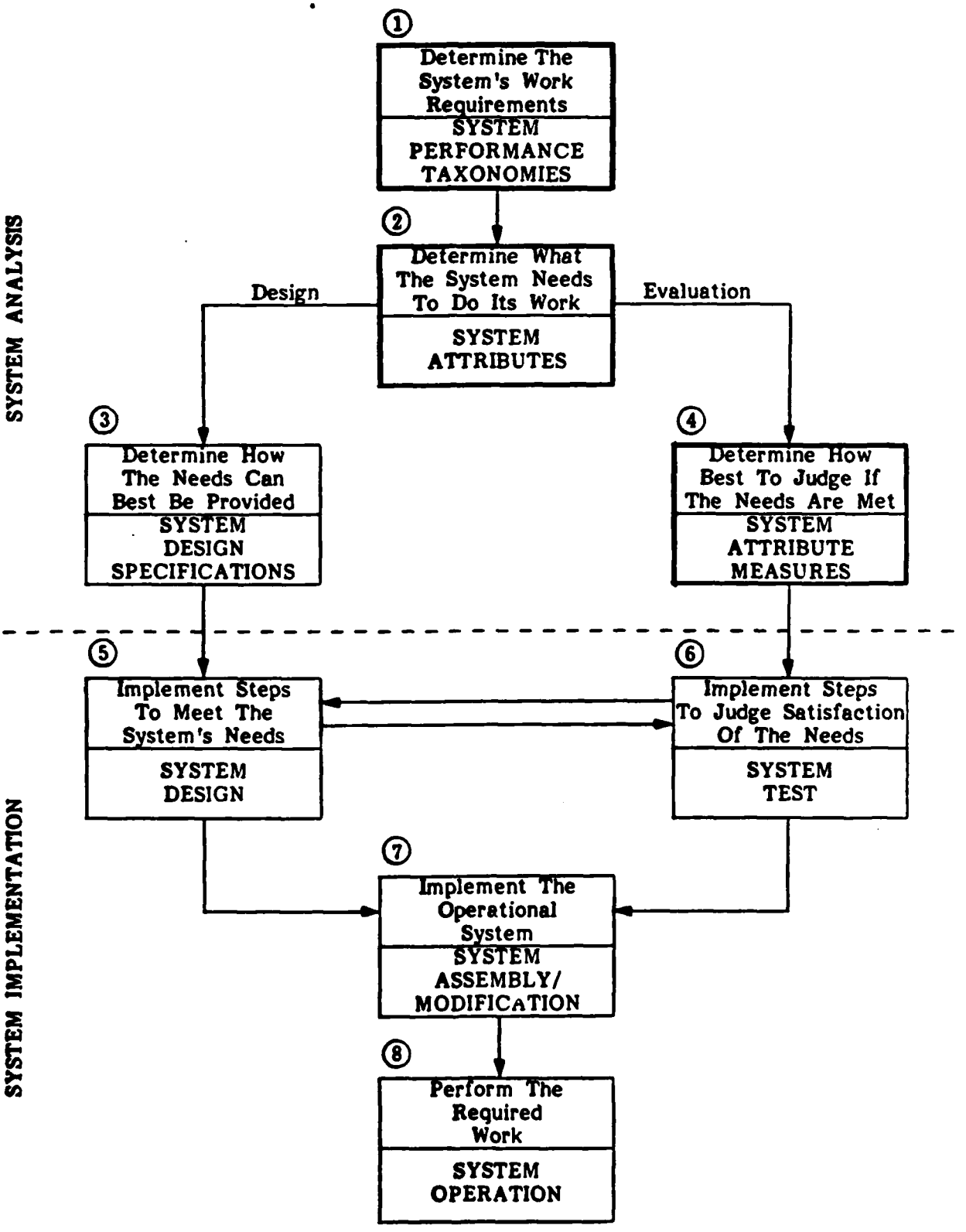


Figure 1. Overview of the APM for System Design and Evaluation

The technical content of this report begins with Chapter II, which is a tutorial introduction to the demonstration system. It is divided into four brief lessons. Lesson #1 teaches the analyst how to start the APM demonstration package and how to analyze performance items (i.e., aspects, objectives, functional purposes and characteristics). Lesson #2 trains the analyst in specifying attributes and measures so that the effectiveness of the system can be evaluated. Lesson #3 guides the analyst through defining a measurement purpose and Lesson #4 shows the analyst how to obtain a paper printout of his entire data base, and it tells the analyst how to specify a new system class, system and/or subsystem.

In Chapter III, the report explains how to assemble and start the Apple computer (including placement of boards, wiring, disks, etc.).

Chapter IV is a listing of the instructions offered by the APM demonstration package.

Chapter V is a listing of the "Help" information that can be called up by the user, if explanations or reminders about the model concepts are needed.

Chapter VI identifies the equipment, supplies and disks required to use this demonstration package.

Chapter VII contains a set of schematic flow charts that leads the reader through the program routines in the most general fashion.

Finally, a separately-bound Appendix provides a briefly annotated listing of the demonstration program, in PASCAL. It should be noted that the program was written for the demonstration purposes only. Its limitations are identified in Chapter II. Future routines for more comprehensive application would differ from this one in numerous places. Recommendations for developing a more comprehensive computer-aided routine in the future are explained in the Final Summary Report cited earlier.

II. APM TUTORIAL*

Welcome to the APM demonstration package. It is designed to help you analyze performance requirements and develop effectiveness measures. The package will ask you a variety of questions. Some will be yes or no questions and others will involve selecting an item from a menu. At other times, you will have the opportunity to type in new performance items, attributes and measures.

If you have never used a computer before, that's no problem. Although I can answer many of the questions you may have, I will, at times, ask you questions. Just think of me as being a sophisticated typewriter and we will get along just fine.

LESSON #1:

You will note that I came with a box of disks. Please open that box of disks and find the disk which is named BOOT SYSTEM. Place your right thumb on top of the word "BOOT," pick up the disk and slide it into the slot in the rectangular box labeled "DRIVE #1." Also, find the disk labeled APM UTILITY and slide it into "DRIVE #2." Push down on the hinge-like device on the front side of both drives 1 and 2 to close the drives. Now, turn on the monitor using the switch which is on the top. Turn on the printer (the switch is on the lower left corner on the back of the printer). Now turn on the computer itself. (The switch is also on the lower left corner of the back side of the computer.)

Relax! In a few minutes, you will see the following message on the upper right corner of the monitor:

Please insert the APM SYSTEM DISK in drive #1 Then press any key to continue

Remove the SYSTEM BOOT DISK from drive #1 and place the APM SYSTEM DISK in drive #1. After you've done that, please press any key on the keyboard. My title page will appear:

*If you need to have an APM term (e.g., objectives) defined, just wait until the term appears on the APM display. Then, type Help (or H) instead of the usual answer to any question. You will then be connected to the APM HELP data base. You will start out by seeing the most useful entry for your purpose. To see related entries, just type in their page number. To peruse all HELP information, go to page 2 (table of contents) and continue on from there. To print the HELP entries, go to Help page 65 and press return. Then answer Y to the question "do you want to print the help information?"

AN ANALYTIC PROCESS MODEL FOR
SYSTEMS DESIGN AND MEASUREMENT:
APPLICATIONS TO TRAINING SYSTEMS

Prepared for: ARI Field Unit, Fort Benning, Georgia
Prepared by: Dunlap and Associates East, Inc., Norwalk, CT
Date: 25 October 1982

PLEASE PRESS ANY KEY TO BEGIN

To proceed, just press any key on the keyboard once again. Now you'll be asked if you would like some instructions:

Would you like instructions (type Yes or No, then press the return key)?

Since this is your first time using the computer, you ought to respond Y (return). Note that you should press the return key following each of your responses to my questions. Now the following message will be displayed--if you did not insert the APMUTIL disk earlier:

Please place the APM UTILity disk (APMUTIL) in drive #2
Please press any key to continue

Insert the disk and press any key to continue. Then the first page of the instructions will be displayed:

WELCOME!

I am happy to present you with the Analytic Process Model (APM) for measurement. I will provide you with menus of performance taxa that you can review for various training subsystems or functions. I will also provide you with application instructions for developing additional training system taxa or even taxonomies of performance for other human-machine systems. Finally, I will aid you in analyzing the performance taxa and developing the significant measurement purposes, the attributes to be measured, and the measures themselves.

I hope that you enjoy working with me!

****PLEASE PRESS RETURN KEY TO VIEW NEXT PAGE****
****PLEASE TYPE PAGE NUMBER AND PRESS RETURN KEY TO VIEW ANOTHER PAGE****
****PLEASE PRESS ESC AND RETURN KEYS TO ESCAPE INSTRUCTIONS****

After reading page 1 you ought to press return to go on to the next page, and so on, until you've read all of the instructions. After you finish reading the last page, you will be asked if you would like to print out a copy of the instructions.

> Would you like to print these instructions?

Since you'll need to reference the instructions throughout your initial few sessions with the demonstration system, I'd suggest that you print out a copy. You do this by responding Y (return). I'll then ask you how many copies you want.

> How many copies?

I'd suggest getting one copy for now. Simply type the number desired (don't forget the return). The instructions will now appear on the printer. When the printer has stopped, press TOF (the white top-of-forms button), and the printer will skip to a new page. Press this button again. Now you may tear your instruction sheets off of the printer. Keep them by your side because you'll probably want to refer to them frequently.

By now, a listing of system classes has appeared on your screen:

> I have data for the following classes of systems:
>
> 1. Communication
> 2. Maintenance
> 3. Navigation
> 4. Training
> 5. Transportation
> 6. Weapon
>
> Which system class would you like to analyze (type Ø for none of the above)?

You will need to tell me which class of systems you wish to use. You'll note that you may choose any system class ranging from communications to weapons. If you prefer, you may define a new system class and teach me all I need to know about it. Since you are just beginning to use this APM System, I would suggest that you use an existing system class for now. In order to continue using these instructions, I will assume that you are interested in training systems. So, let's suppose that you have typed the number 4 (followed by a carriage return) to indicate that you wish to select the training class of systems.

Now I'll need to know which system you wish to analyze, so a list of systems will appear on the screen:

```
I have data for the following systems of system class:  Training
     1.  Bradley Infantry Fighting Vehicle Training System
         (BIFVTS)

Which system would you like to analyze (type Ø for none of the
above)?
```

You may choose from a host of systems including the BIFV Training System (BIFVTS), or you might wish to create your own training system. Let's suppose you select option #1 (BIVTS) so that you can continue with these instructions.

You've thus far selected to use the TRAINING CLASS OF SYSTEMS and the BIFVTS SYSTEM. Now, you'll have the opportunity to select a subsystem. Once again, I'll offer you a wide selection of subsystems.

```
I have data for the following subsystems of system: Bradley
 Infantry Fighting Vehicle Training System (BIFVTS)
     1.  Command
     2.  Delivery
     3.  Design
     4.  Emplacement
     5.  Enabling
     6.  Logistics

Which subsystem would you like to analyze (type Ø for none of the
above)?
```

This demonstration package currently contains data for only the enabling, design and delivery subsystems. Let's suppose that you choose the design subsystem.

Now you've told me exactly what system you want to use. It is time to tell me what you want to do with the system, so the following menu will appear on the screen:

```
System Class:  Training
System:  Bradley Infantry Fighting Vehicle Training System
         (BIFVTS)
Subsystem:  Design

You may perform the following analytic procedures:

     1.  Add, modify, or delete performance items
     2.  Add, modify, or delete measurable attributes or measures
     3.  Add, modify, or delete measurement purposes
     4.  Print out selected results from your analysis
     5.  Pack your disk files most efficiently (a slow process)
     6.  Change System class, System, and/or Subsystem to be
         analyzed
     7.  Review Instruction
     8.  Stop for now
Which would you like to do?
```

You could, for example, analyze the performance items which compose the system or you could analyze the attributes and measures for a particular set of performance items. Alternatively, you might wish to specify a measurement purpose, or you might wish to print out the entire data set.

If this is, indeed, your first time using the APM Demonstration Package, you ought to become somewhat familiar with the data sets that you'll be analyzing. Thus, I would suggest that you go right to option 4 and print out the data set. You may do this by typing a 4 (return) to the menu of options which is available for you. The following message will appear on the screen:

```
System class:  Training
System:  Bradley Infantry Fighting Vehicle Training System
         (BIFVTS)
Subsystem:  Design

If the disk for this system class, system, and subsystem is
     available, please place it in Drive #2 and type Y (return).
     Otherwise, type N (return).
```

Please insert the appropriate disk and type Y (return). You will be asked to type in your name, the title of your analysis and today's date. Type these in any format you wish.

Now you'll be asked which measurement purpose you have in mind. It is essential that you understand what a measurement purpose is. "The measurement purpose for a particular application of the Analytic Process Model to some system is the specific work of that system that is to be evaluated in the application. A measurement purpose is equivalent to the particular sub-taxonomy of system performance requirements for which measures are to be selected and applied." This definition is one of a set of definitions and terms included in the demonstration package. It is available if you respond "H" to various questions in the demonstration package. If you have a specific purpose for doing today's analysis and your purpose just happens to be included on the measurement purpose list, then I would suggest that you specify that number and print it out. In all likelihood, at this time you don't have a specific purpose in mind (or if you do, the purpose is not included in the list of purposes available). Thus, you probably ought to type a Ø(return). Now, I'll ask you if you wish to eliminate any items from your printout. For now, respond No and a complete printout of the subsystem which you've selected will appear on the printer. The printer may take awhile to list out the entire data set.

When the printing is finished, a list of questions will appear on the screen. Respond No to each of them until the analytic procedure menu reappears on the screen. When the menu reappears, select option #1 to add, modify, or delete performance items. As soon as the program loads, you will see a list of the various system aspects which are available to you.

```
You are currently analyzing subsystem Design of the Training class
     of systems

To proceed with the analysis you may examine the following aspects
     of performance:
     1.  Potentialities
     2.  Processes
     3.  Products
     4.  Environment
     5.  Constraints
     Ø.  Select a different analytic procedure

Which aspect of subsystem Design would you like to analyze?
```

If you don't know what an aspect is, ask for help by typing H (return) instead of a numeric answer! Although all aspects do contain some performance items, I would suggest that you select aspect #1, potentialities, for now.

Now that you've selected to analyze potentialities, I'll show you a list of Objectives which are part of this aspect.

```
*Training Systems  *Bradley Infantry  *Design  *Potentialities

Objectives--The system must be capable of:

1.  Identifying goals and priorities
2.  Establishing performance objectives
3.  Analyzing performance objectives
4.  Defining training content
5.  Defining training procedures
6.  Evaluating the curriculum

You may perform any of the following procedures:

1.  Analyze functional purposes     2.  Specify a new objective
3.  Remove an objective             4.  Reword an objective
5.  Print these objectives          6.  Analyze a difference aspect
7.  Select a different analytic proc.
Please select one:
```

Start with option #5 and obtain a printout of the objectives list. Now, compare this list with the printout of the entire data set. Make sure that you find the objectives in the data set. Once you've found them, you might wish to improve the wording of an objective. Do this by selecting option #4. You will then be asked which objective you wish to reword:

```
*Training Systems  *Bradley Infantry  *Design  *Potentialities

Objectives--The system must be capable of:
1.  Identifying goals and priorities
2.  Establishing performance objectives
3.  Analyzing performance objectives
4.  Defining training content
5.  Defining training procedures
6.  Evaluating the curriculum

     You have chosen to reword an objective.
     Which one do you want to reword (Type 0 to reconsider)?
```

Select one objective and type in its number followed, of course, by a return. Now, you'll have the opportunity to type in the improved objective.

```
*Training Systems  *Bradley Infantry  *Design  *Potentialities

Objectives--The system must be capable of:
1.  Identifying goals and priorities
2.  Establishing performance objectives
3.  Analyzing performance objectives
4.  Defining training content
5.  Defining training procedures
6.  Evaluating the curriculum

Please reword (80 characters available) this objective.

The system must be capable of:
```

Your reworded objective ought to provide a suitable conclusion to the sentence which begins on the last line of the display.

When the screen display is refreshed, your reworded objective will appear in the objectives list. Next, I would suggest trying to delete an objective, so that when the main menu reappears, select option #3. The following message will appear at the bottom of the display:

```
Which one do you wish to remove (type 0 to reconsider):
```

Followed by:

```
Do you really want to remove this objective and component
Functional purposes?
```

Now, try option #2 to add a new objective. The following display will appear:

*Training Systems *Bradley Infantry *Design *Potentialities You have chosen to create a new objective. Please specify (80 additional characters available) the new objective within the Potentialities aspect of the Design subsystem The system must be capable of:

Type in the new performance item. Then OK will appear, followed by:

It will, at some time, be necessary to add Functional purposes and Characteristics to this objective. Would you like to specify Functional purposes at this time?

Respond N for now. Then the following question will appear:

Would you like to specify more objectives?

Respond N for now.

Now, type option #7 to return to the aspect level. Select aspect #1 to return to objectives. Now you've seen how you can go backwards using the APM. Let's go one step further back--select option #8. I'll leave it to you to get back to processing (if you get into trouble, just backtrack through these directions).

Now that you have mastered the art of adding, deleting and rewording objectives, it is time to gain some experience manipulating functional purposes. Please select option #1--analyze functional purposes. Since the APM structure is hierarchical in nature, it is only possible to analyze the functional purposes for one objective at a time. So, the following message will appear on the bottom of the display screen:

Which objective would you like to analyze (type Ø to reconsider)?

You might select to work with the functional purposes which explain objective #1 for now. Please type a 1 (return). Now you will see a new display:

*Training Systems *Bradley Infantry *Design *Potentialities
Objective: [1] Identifying goals and priorities

Functional purposes--This system capability allows:

1. Defining the total scope of learning
2. Stating the ultimate intended outcomes of learning
3. Identifying the relative importance of intended outcomes
4. Establishing a basis for specifying learning objectives

You may perform any of the following procedures:

1. Analyze characteristics	2. Specify new functional purposes
3. Remove a functional purpose	4. Reword a functional purpose
5. Print these functional purposes	6. Analyze a different objective
7. Analyze a different aspect	8. Select a different analytic proc.

Please select one:

Let us now go through all of the options, as we did at the objectives level. First, let us specify a new functional purpose. To do this, type 2 (return, of course). The following display will appear on the screen:

*Training Systems *Bradley Infantry *Design *Potentialities
Objective [1]: Identifying goals and priorities

You have chosen to create a new functional purpose.

Please specify (80 characters available) the new functional purpose within the Potentialities aspect of the Design system.

This system capability allows:

Now, type in the new functional purpose. The computer will respond with the word Done followed by two additional questions:

It will be necessary, at some time, to add characteristics to this Functional purpose.
Would you like to specify new characteristics at this time?

Respond No to this first question. Then a second question:

Would you like to specify more functional purposes for this objective?

Respond No to this question also (unless you wish to add additional functional purposes. Now the main menu of options will reappear. Specify option #4, to reword a functional purpose. The following message will appear at the bottom of the screen:

> You have chosen to reword a functional purpose
> Which one do you want to reword (Type Ø to reconsider)?

Type in the number of the functional purpose that you wish to reword. Then, the following message will appear at the bottom of the screen:

> Please reword (80 characters available) the functional purpose
>
> This system capability allows:

Type in the reworded functional purpose followed by a return. OK will appear at the bottom of the screen, followed by a repainting of the main functional purposes display (notice that the reworded objective has, indeed, been reworded!) Now let's remove a functional purpose. Type in option #3. The following question will appear on the screen:

> Which one do you want to remove (Type Ø to reconsider)?

Type in the number of the functional purpose you wish to delete. Then, the question

> Do you really want to remove this functional purpose and associated characteristics?

will appear. Respond Yes. The items will disappear and the main functional purposes menu will reappear.

At this time, you ought to try option #5, print these functional purposes. Also, you should try option #6 to analyze a different objective. (Now, try option #1 to return to the functional purposes level--why not analyze objective 2 (or 3) this time?) Now, try option #7. Work your way back down to the functional purpose level (if you get lost, retrace through these instructions). Do the same using option #8.

Now you are thoroughly familiar with the aspects, objectives and functional purposes. You need, however, to practice manipulating characteristics. So, return to the objectives level and specify option #1. When the message [Which functional purpose would you like to analyze (Type Ø to reconsider)?] appears, choose purpose #1 for now. The following display will then appear:

*Training Systems *Bradley Infantry *Design *Potentialities
Objective: [1] Identifying goals and priorities
Fctl Prps: [1] Defining the total scope of learning

Characteristics--For this purpose, the system must have the potential for:

1. Identifying types of achievements relevant to the intended job
2. Analyzing achievements to determine suitability for training

You may perform any of the following procedures:

1. Specify new characteristics	2. Remove a characteristic
3. Reword a characteristic	4. Print these characteristics
5. Analyze a different func. purp.	6. Analyze a different objective
7. Analyze a different aspect	8. Select a different analytic proc.

Please select one:

You ought to become familiar with the various commands. Start by experimenting with options 1-4. You will discover that they operate in a manner very similar to the parallel commands for the objectives and functional purposes level taxa. Now you ought to develop facility with working on all levels of the APM using commands 5-8. Once again, if you run into any difficulty, review the earlier commands in this instruction set. Try to add an objective with all of its component functional purposes and objectives to the Objectives level. Add (option 1) a new objective. When the question "would you like to add functional purposes at this time" appears, respond Yes. Add a functional purpose. When it asks you if you want to add a characteristic within the functional purpose, respond Yes again. Add the characteristic. Now return to the objectives level and run through the entire tree to find all of the entries which you have just made. Once you complete this, you will have mastered the process of analyzing performance items using the APM. Congratulations!

Stop for today by selecting a new analytic procedure. When the list of analytic procedures appears, select option #8 (Stop for Now). The computer will ask you if you want to stop for now. Respond Yes. Now the computer will tell you what to do to turn the machine off.

LESSON #2

In Lesson #1, you learned how to analyze performance items. In Lesson #2 you will learn how to specify the measurable attributes and the attribute measures, so that you can evaluate the effectiveness of your system.

First, however, take about 10-15 minutes to review Lesson 1--analyzing performance items. Then select analytic procedure 2--add, modify, or delete measurable attributes or attributes of measures.

You will find that the procedures for analyzing attributes and measures are very similar to the procedures for analyzing performance items. The following display will appear on the computer screen:

```
System class:  Training
System:  Bradley Infantry Fighting Vehicle Training System
         (BIFVTS)
Subsystem:  Design

Would you like to begin analyzing the first performance item?
```

Unless there is another item with which you would rather begin, respond Yes. (If you respond No, you will be presented with a list of aspects--and will choose the one you want to process. Then, you will be presented with the objectives within the aspect selected--and will choose the one you want to process. The same process will be repeated for functional purposes and characteristics.) The following display will appear:

```
*Training Systems  *Bradley Infantry *Design     *Potentialities
Objective: [2] Establishing performance objectives
Fctl Prps: [1] Stating expected performance and behavior after
     training
Charstics: [1] Defining the performance action

Measurable Attributes--To evaluate effectiveness in meeting this
     characteristic, the following system attributes can be measured:

1. [1.2.1.1.1.] Types of BIFV gunner performance actions intended
     to be defined
2. [1.2.1.1.2.] Plans for defining actions required of BIFV gunners

You may Perform any of the following procedures:
1.  Examine measures for an attribute   2.  Add new attributes
3.  Reword an attribute                 4.  Remove an attribute
5.  Print these attributes              6.  Proceed to the NEXT
                                            perf item
7.  Proceed to ANOTHER perf item        8.  Select a different
                                            analytic proc.
Please select one:
```

I would suggest that you add a new attribute for the performance item displayed. This is done by specifying option #2. The following message appears:

```
Please type the new attribute descriptor:
.............
```

Please specify in 68 characters (or fewer) the new attribute descriptor. Then, the main attributes display will reappear.

Now, try option #3, Reword an attribute. I will ask you

```
Which one (type Ø if done)?
```

Respond with the number of the attribute you wish to reword. The message

```
Please type the new attribute descriptor:
.............
```

will appear. Please type in the new attribute descriptor. Once again, the main attribute display will appear. Now try to delete an attribute. I will ask

```
Which one (Type Ø if done)?
```

Respond with the number of the attribute you wish to have me delete. Once again, the main attribute display will reappear. You might also try to print out the attributes (option #5).

Now try option #6 to examine the attributes for the next performance item. Try option #7 to change to another performance item. (If you should decide that you do not wish to process other performance items, type ESCape (return) to exit from this program.)

It is time to examine the measures for an attribute. So, specify that you want option #1 when the main menu is available. If there are no attributes, the computer will NOT let you specify measures (just as tree branches don't grow without a trunk and roots). If there are attributes, the computer will ask you which one you want to analyze. Why not try #1 for a starter, then a display like the one which follows will appear:

```
*Training Systems  *Bradley Infantry *Design     *Potentialities
Objective: [2] Establishing performance objectives
Fctl Prps: [1] Stating expected performance and behavior after
           training
Charstics: [1] Defining the performance action

Measurable Attributes--To evaluate effectiveness in meeting this
     characteristic, the following system attributes can be measured:
Types of BIFV gunner performance actions intended to be defined[1]
Measures--This system attribute can be analyzed by comparing the
     following parameters with established criteria:
1.  [1.2.1.1.1.1.] Relevant types of actions not intended to be
     defined
2.  [1.2.1.1.1.2.] Irrelevant types of actions intended to be defined
3.  [1.2.1.1.1.3.] Reviewers' ratings of observability of types of
     actions defined

You may perform the following procedures:
     1.  Add new measures   2.  Reword a measure
     3.  Remove a measure   4.  Print these measures
     5.  Return to Attributes Level
Please select one:
```

Try to add, reword, remove and print the measures. You will notice that the procedures are very similar to the procedures which you used to analyze the attributes. Finally, choose option #5 to return to the attributes level. Continue to practice modifying attributes and measures until you feel very comfortable doing so. Then respond 8 to return the attributes main menu, to select another analytic procedure. At this time, you may either go on to Lesson 3 or choose analytic procedure 8, Stop for Now.

LESSON #3

Start out by reviewing the analytic procedures for processing "performance items" and "attributes and measures." Once you have reviewed these procedures for 20 minutes or so, you ought to pack your data sets efficiently. This can best be accomplished by running analytic procedure #5. So, why don't you do that at this time. If you do take the time to do this, you will SAVE time with the remainder of today's lesson.

After you specify option #5, you will be asked to place the APM UTILity disk in drive #1 (NOTE that this disk will replace the APM system disk in drive #1). After packing is completed (about 10 minutes later), the computer will ask you to place the APM system disk back into drive #1 and press any key to continue.

Now let us work on specifying measurement purposes. Measurement purposes, as you may recall, are reasons for performing your analysis. If you specify option #3, the list of measurement purposes currently defined in this system will appear along with a menu of the analytic procedures which can be performed using the computer package. The menu will appear to be very similar to the following display:

The following measurement purposes are currently included in the APM:

1. To evaluate training design subsystem effectiveness in specifying learner testing

2. To evaluate training design subsystem effectiveness in specifying training methods

3. To evaluate training design subsystem effectiveness in specifying learning aids

4. To evaluate training design subsystem effectiveness in specifying facilitator requirements

You may perform any of the following procedures:

1. Analyze a measurement purpose	2. Specify a new measurement purpose
3. Remove a measurement purpose	4. Replace a measurement purpose
5. Pack meas purposes efficiently	6. Select a different analytic proc.

Please select one:

Currently the system allows you to specify up to 5 measurement purposes. So, why don't you start by specifying a new measurement purpose (option #2). The following message will appear on the bottom of the screen:

Please describe the new measurement purpose in two 68 character lines
Please type line #1:

After you type in line #1, the following message will appear:

Please type line #2

After you type in line #2, the main menu will reappear.

If you select to replace a measurement purpose, you will be asked

Is this replacement merely an improvement in the descriptor?

If you respond Yes, then the association between the measurement purpose descriptor and the performance items will not be deleted, otherwise, they will

be. Regardless of how you answer the question, you will be given the opportunity to describe the new measurement purpose name in 2 lines (just like adding a measurement purpose).

Removing a measurement purpose merely results in your being asked which one you want to remove. Then the removal is performed.

Option #1, analyze a measurement purpose, is a unique process in the APM. You will be shown a list of all of the characteristics (in successive frames, grouped so that you will see the characteristics for one functional purpose at a time). If the characteristics are associated with the measurement purpose, they will appear to be dark letters on a light background. If they are not to be included, then they will be light letters on a dark background. You may change the associations by saying Yes, then responding with the number of the item you wish to change (when asked which one you wish to change). You may change all items by typing 999, or you may change no items (and proceed to the characteristics for the next functional purpose) by responding Ø. If you wish to quit before finishing the process simply press the ESC and return keys rather than the Y or N keys in responding to the computer's questions. When finished, the measurement purpose display and menu will reappear. You will then have the opportunity to process another measurement purpose or return to the main menu.

LESSON #4

Start out by reviewing analytic procedures 1-3. Now let us print out the revised data set which we produced in Lessons 1-3. Specify analytic procedure #4. You will be asked to specify you name, job title and today's date. Then the title page will be printed. You will see, once again, the list of measurement purposes which you might like to print. Specify that you would like to use measurement purpose 5, the one you constructed in Lesson #3. Now you will be asked if you wish to eliminate any performance items from the printout. You might, for example, want to make some temporary changes to your performance item list which you do not want to enter in the disk file before doing the printout. If you do, respond Y. You will be asked whether you want to eliminate at the level of objectives, functional purposes or characteristics. You will then be shown one performance item at a time and will have the option to respond Y (keep it) or N (delete it). In either case, the performance items will print after this step (IS THE PRINTER ON AND ONLINE?). Should you wish to stop printing before the entire data set has printed, simply press the ESC key. Within a few seconds the printer will stop, the message JOB CANCELLED will appear on the printout, and you will be asked some more questions.

After the data set is printed, you will be asked if you wish to eliminate more performance items. If so, respond Yes and the elimination/print cycle will be repeated. Otherwise, respond N and you will be asked if you wish to examine another measurement purpose (perhaps try the global purpose to print the entire data set this time?). If you respond Yes, the process will be repeated. Otherwise, the printer will advance the paper and you will be returned to the analytic procedure menu.

OPTIONAL:

To create a new system class, system or subsystem when you have the option of selecting an existing system class, system or subsystem specify

option 0 (none of the above). You will then have a dialogue with the computer (sample follows) as you are guided through developing your new system.

```
Would you like to develop a new class of systems? Y
What is the name of your new class of systems? Unknown
System class Unknown has been added to the list of system classes
     as system number?
Would you like to define new systems for system class Unknown? Y
What is the name of your system? Unknown
System Unknown is member number 1 of system class Unknown
Would you like to proceed with the analysis of system class
     Unknown, system Unknown? N
Would you like to add more systems to system class Unknown? N
```

The computer will refer you to the appropriate Apple documentation for setting up a new disk for the new data base at the appropriate time.

Conclusion:

Congratulations! You have now completed the basic tutorial course in using the APM demonstration package. Take a moment to review Table 1, the limitations of the demonstration package which are caused by the relatively limited capabilities of the equipment, then you will be fully able to use the package. I hope you will enjoy using the demonstration package for your particular applications.

Table 1. Limits of the APM Demonstration Package

Storage Capacity:	Max. No. Characters/Item Name	Max. No. Items
Systems Classes	80	10
Systems	80	10/System Class
Subsystems	80	10/System
TOTAL Systems Classes and Systems	80	20 Total
Aspects	predefined	5/Subsystem
Objectives	80	20/Aspect
Functional Purposes	80	20/Objective
Characteristics	80	20/Functional Purpose
TOTAL Objectives, Functional Purposes and Characteristics/Subsystem	80	300/Subsystem
Attributes	68	20/Characteristic
Measures	68	20/Attribute
Total Attributes/Subsystem	--	200/Subsystem
Total Measures/Subsystem	--	400/Subsystem
Measurement Purposes	36	5/Subsystem
Associations/Measurement Purpose	--	225/Measurement Purpose

Processing Limits:

Maximum number of new items which can be added to a data set during a single use of an analytic procedure: 25

Overall disk access, printing and CPU speed is slow!

When performance items are deleted, companion attributes and measures are not deleted (although they become unaccessible, adding a replacement item reactivates the items!)

When using double-sided disks, it may not be possible to pack the enabling subsystem data files without first copying the APMUTL onto another disk.

III. STARTING THE APM DEMONSTRATION PACKAGE

A. Set up the computer (if the computer is already set up go to STEP B).

1. Remove the computer, 2 disk drives, printer, display screen and printer paper from their carrying cases. (Allow these items to adjust to room temperature before turning them on.)

2. Arrange items on display table as desired (e.g., put computer on a table which is at a convenient height for typing. Place the two disk drives on the right of the computer (place drive #1 on top of drive #2) about 6-8 inches from the computer. Place the printer about 3-4 feet away from the computer (for observers).

3. Be certain that all on/off switches are turned OFF! Plug computer, display screen and printer into wall outlet.

4. Printer Preparation.

   a. Place box of paper on floor under the printer table.
   b. Remove the plastic cover from the top of the printer.
   c. Grasp the top sheet of paper and push it through the slot on the front side of the printer.
   d. Look down at the printer and you will see the paper begin to appear.
   e. Grasp the paper and pull it up until the perforated edge is even with the metal edge about 2 inches down into the printer.
   f. Grasp the clamps on the left and right sides of the paper, lift them up and put the paper inside the clamps, so the fold on the paper is just below the clamp. Push them back down.
   g. Place the plastic cover on top of the printer.

5. APPLE II Preparation

   a. Open the cover to the APPLE II--this is done by placing one hand on the back of the top part of the computer in the center and pulling up very hard while using the other hand to hold the computer in place.
   b. Arrange all loose wires so that they come through the slots in the back of the machine.
   c. Place all boards where they belong and connect all wires to all boards. (If the boards and wires are in place, go through this procedure and check them to be sure they are tight--FAILURE TO PERFORM THIS PROCEDURE PROPERLY MAY DAMAGE THE COMPUTER!
      (1) The slots at the back of the computer are commonly referred to by number. Remember, the one on the left (when viewed from the front) is Ø, the next one is 1...until the rightmost is 7.
      (2) Place the memory expansion board (the one without wires) in slot #Ø. Be sure that all chips (the little black components which are about 3/4" x 1/4") are tightly positioned on this board by pressing lightly on each one. Be sure the board is tightly positioned.

(3) Leave slot #1 vacant.
(4) Place the serial interface (the board which will connect to the printer) in slot #2. (This board has one set of prongs on the right side.) Place this board in firmly and check all chips for tightness. Connect the multi-colored wire which originates at the printer into the prongs on this board. NOTE: You may find it easier to plug the cable into the board before placing the board in the slot, but be sure that you make all connections tight regardless of the order in which you make the connections.
(5) Place the VIDEX board (the one with four little prongs sticking out of the back side) in slot #3. Check all chips for tightness. Check board to be sure it is tightly positioned. Attach the wire which runs from the elevated platform on the right side of the main board inside the computer to the four prongs on the back of the board in slot 3. NOTE: Unless you force it, you won't be able to put the wire in incorrectly!
(6) Leave slot #4 vacant.
(7) Place the disk controller--the board with two sets of prongs on the side in slot #6. Connect the ribbon cable to drive #1 to the prong set of this board and the cable to drive #2 to the bottom prong set. Again, be sure that everything is tight.
(8) Check the main computer board (the "mother board") and press down on any lose chips.
(9) Place the cover back onto the computer. Press firmly on both corners so that it locks.
(10) Place the display screen on top of the computer. Connect the wire leading out of the computer (from the VIDEX board) into the wire leading out from the display screen.

B. Starting the Computer After It Is All Set Up.

1. Place disks in drives.

   a. Remove the BOOT and the APMUTL disks from the box of disks.
   b. Open the two disk drives by pulling up (lightly) on the hinges on the front of each drive.
   c. Place your right thumb on top of the label BOOT. Keeping your thumb on top of the disk, slide it into drive #1. Close the drive by pressing down lightly on the drive #1 door.
   d. Place your right thumb on top of the label APMUTL. Keeping your thumb on top of the disk, slide it into drive #2. Close the drive by pressing down lightly on the drive #2 door.

2. Turn on the printer.

3. Turn on the display screen.

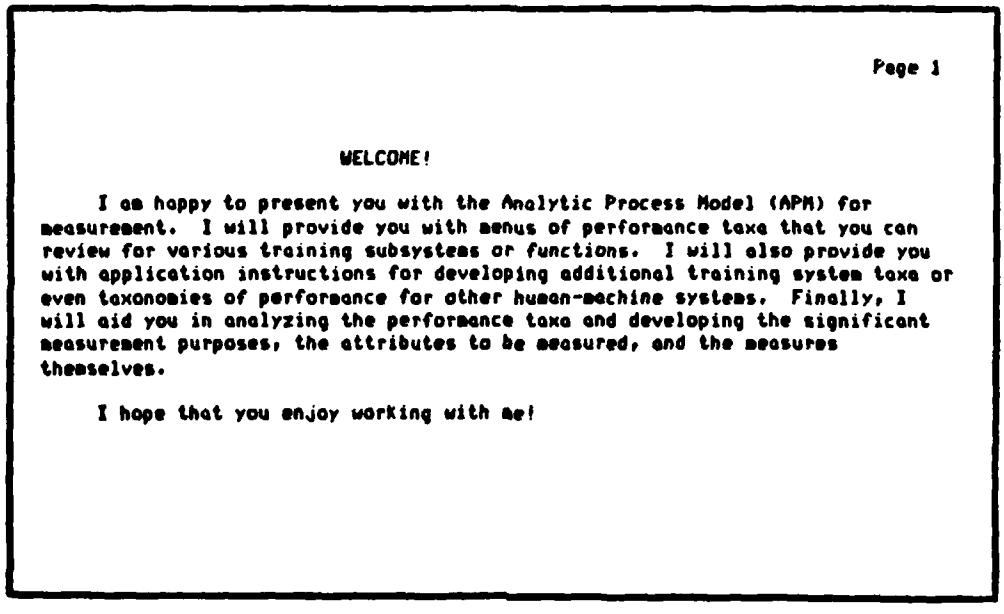
4. Turn on the computer.

5. The disks should start to spin and, within a few minutes, you ought to see the APM SYSTEM title page. If you do not, turn off computer and recheck installation a few times. If you still get no response, call APPLE REPAIR.

C. The APM Demonstration Package will give you further instructions/directions as you use it.

IV. OPERATING INSTRUCTIONS FOR THE APM DEMONSTRATION PACKAGE

The APM demonstration system asks the analyst if he/she would like instructions on using the computer aided model immediately after the title page is displayed in the GREETING program. The analyst also has the option of requesting instructions by selecting option #8 when the analytic procedure menu is displayed. If the analyst requests instructions, the following instruction set is displayed on the screen:



Page 1

WELCOME!

I am happy to present you with the Analytic Process Model (APM) for measurement. I will provide you with menus of performance taxa that you can review for various training subsystems or functions. I will also provide you with application instructions for developing additional training system taxa or even taxonomies of performance for other human-machine systems. Finally, I will aid you in analyzing the performance taxa and developing the significant measurement purposes, the attributes to be measured, and the measures themselves.

I hope that you enjoy working with me!

Page 2

PROCEEDING THROUGH A DEMONSTRATION SESSION

As soon as you finish reading this set of instructions, you will have an opportunity to select which system class you wish to work with today. I'll first display a list of the system classes which other analysts have defined for me. You will have the opportunity to select which of these you would like to use. If none of these meet your needs, you are welcome to develop a new system class. System class selection is a very simple process. After I show you the names of all of my system classes, I'll ask you which one you want to use. Type the number of the system followed by a return key. If you want to develop a new system class, type 0 (return), and I'll ask you for the name of the new system class.

Page 3

HINTS

If you are tired today, you may simply type Y or N. If you get confused at any point, instead of typing an appropriate Y, N or numeric response, simply type H or HELP. I'll either give you some HELP or refer you to an appropriate page in the APM SYSTEMS MANUAL. For your final hint! if you type an illegal answer to a question, I will simply tell you what the legal responses are, and will then allow you to once again, answer the question.

Hold down the CTRL key, and press the A key if you wish to use both upper and lower case display characters during your session.

Page 4

SYSTEM AND SUBSYSTEM SELECTION

As soon as you select your system class, I'll introduce you to all of the systems that have been defined for that class. I'll ask system you wish to use. Type in the number of the system you wish to use (as you did to select the System Class). If you wish to develop a new system, I'll give you the opportunity to describe your new system (in one 80 character line). You will then select subsystems following the same procedures which you used for system selection.

Page 5

WHAT DO YOU WANT TO DO NEXT?

I'll show you a list of the analytic procedures which I can help you perform. They include:

1) Specifying performance items
2) Specifying ways to evaluate performance items (attributes and measures)
3) Specifying purposes of a given evaluation (measurement purposes)
4) Printing selected results from your analysis
5) Packing the information on the computer disks efficiently
6) Selecting a different system and/or subsystem
7) Reviewing these instructions
8) Stopping.

You'll be asked to select an analytic procedure. If you select procedures 1, 2, 3, 4, or 5, you'll be asked to change the disk in DRIVE # 2. Insert the appropriate disk, and type a Y (return). If you do not have the disk, type an N (return). If you say N, I'll ask if you want to make a disk. If so, I'll tell you how to do it. If not, I'll give you the opportunity to select another system class, system and subsystem, review the instructions, or stop.

Page 6

ANALYZING PERFORMANCE ITEMS

If you select the first option, I will work with you in the 5 by 3 matrix of the APM shown on the next page. First, I'll show you a list of the five performance aspects of each and every subsystem that exists:

1) Potentialities
2) Processes
3) Products
4) Environmental Constraints
5) General Constraints.

Your selection of one item at a time from this list will reflect your current preference to analyze either the systems inherent capabilities, the activities it carries out, the goods or services it delivers, the naturally occuring setting for its operation, or the humanly imposed conditions for its operation, respectively.

Page 7

ANALYZING PERFORMANCE ITEMS (continued)

	POTENTIALITIES	PROCESSES	PRODUCTS	ENVIRONMENT	CONSTRAINTS
OBJECTIVES	#	#	#	#	#
FUNCTIONAL PURPOSES	#	#	#	#	#
CHARACTERISTICS	#	#	#	#	#

Page 8

ANALYZING PERFORMANCE ITEMS (continued)

After you make this selection, I'll show you the three successive levels of system operation:

1) objectives
2) functional purposes
3) characteristics.

Your selection of one item at a time from this list will reflect your current preference to analyze either the system's overall work requirements, the reasons and subordinate functions associated with each requirement, or the ways of satisfying and implementing the system's functions, respectively.

You will have an opportunity to add more objectives, remove objectives, or reword objectives. You will also have the opportunity to find out why each objective is important as you explore its related functional purposes. I'll allow you to add, reword, or remove functional purposes. You will also have the opportunity to find out how to analyze each functional purpose by reviewing the performance characteristics for each one. You may also add, reword, or remove characteristics. The resulting lists of objectives, functional purposes, and characteristics for each of the five performance aspects constitute the complete set of performance items for your subsystem.

Page 9

ANALYZING PERFORMANCE ITEMS (continued)

After you have completely edited a page of text, it is a good idea to make a paper copy of it. This may be done by simply selecting the print option.

As you finish analyzing an objective, functional purpose, or characteristic, you will have the opportunity to analyze a different 1) functional purpose, 2) objective, or 3) performance aspect, or perform a different analytic procedure (remember, STOPping is an analytic procedure!).

Page 10

ANALYZING MEASUREMENT PURPOSES

Since every performance item may not be relevant to your present measurement purpose, I will help you subdivide the list of performance items to suit your needs. You will have the opportunity to specify (in 2 lines) a description of your purpose for performing a measurement. Then, you will review performance items to determine whether they are relevant to the particular measurement purpose. You may form links to the relevant ones, and delete links to irrelevant ones. I have a library of measurement purposes which will be shown at the start of the procedure. You may, thus, use one of my purposes if it matches yours. You may start by examining the first performance item, or by specifying a particular performance item. If you chose to select a performance item, I'll display the hierarchy of performance items to help you find the one you want. After you have examined the performance items which interest you, just press the ESCape and return keys to complete the examination procedure.

Page 11

ANALYZING ATTRIBUTES AND MEASURES

After you've completed the analysis of performance items, you may wish to find out which concrete, observable attributes are associated with each performance item. You may also wish to find out what to measure for each attribute.

You will be shown, for the selected performance items, the relevant attributes about which I know. Then, you will have the opportunity to reword, add, or remove attributes. You will have the opportunity to analyze measures for each attribute. In general, this analytic procedure operates the same way that the procedure for specifying performance items operated.

Page 12

PRINTING SELECTED RESULTS FROM YOUR ANALYSIS

You will have the opportunity to specify whether you would like to print out all performance items or those for a specific measurement purpose. Then, you will have the opportunity to weed out objectives, functional purposes, and characteristics which are not relevant to the current analysis.

After you complete the selection process (or after you tell me that you don't want to perform the selection process), I'll print out all relevant performance aspects with their component objectives, functional purposes, characteristics, attributes, and measures. Then I'll give you the opportunity to review your printout and either 1) make another copy, 2) do some more weeding out, 3) select a different measurement purpose, 4) select a different analytic procedure (e.g., STOP).

To cancel the printout after it has started, just hit the ESCape key and wait a minute or two. The message job cancelled will be printed, and the computer will ask you some questions about what you want to do next.

Page 13

PACKING YOUR DATA SETS

In order to process your data sets more rapidly, and allow you to fit as much data as possible into each of your sets, I suggest that you run this analytic procedure once after each major change in any data set.

WARNING: This may be a slow procedure, and it will, furthermore, make the next run of the PRINT procedure for each measurement purpose VERY SLOW!

INSTRUCTIONS
(conclusion)

A FEW FINAL WORDS OF CAUTION:

1) Do not EVER remove your disks before the computer tells you that you ought to change disks, or that you may remove the disks.
2) Do not EVER turn off the computer or press the control and reset keys simultaneously during a session.

If you fail to follow the above warnings, you may either confuse or destroy your data sets, leading to unpredictable results and/or program failures.

3) Do not ever use the original disks (the ones with the holes covered by silver tape). They will cause unpredictable program failure, and running them may (not likely, but still) ruin them. These disks are only to be used in an emergency as 'master disks' which may be copied using the Transfer procedure of the APPLE II Files program.

GOOD LUCK! HAVE FUN! KEEP ME WORKING VERY HARD!

--your friendly APM demonstration system

V. HELP MESSAGE LISTINGS

The analyst has the opportunity to request help by responding H or HELP instead of giving the usual response to the computer whenever a menu or a question appear. The help message displayed will be the one most relevant to the question at hand. In general, the help messages serve to define APM terms and explain APM concepts which may be unclear to the analyst. Cross references to other help messages appear at the bottom of many pages and a table of contents of all help messages appears on page 2. Whenever a help message is shown, the analyst will have the option to review other help messages by simply typing in the page number of the desired message. A complete listing of the help file follows:

```
                                                              Page 1

                        HELP COMMANDS & GLOSSARY
```

```
                                                              Page 2
TABLE OF CONTENTS
  Analytic Process Model.....5        Design.....20
  APM.....7                           Design Specification.....21
  Aspects of Performance.....8        Design Subsystem.....22
  Attribute.....10                    Emplacement Subsystem.....24
  Characteristics Level Taxa...12     Enabling Subsystem.....25
  Collateral System.....15            Evaluation.....29
  Command Subsystem.....16            Facilitator.....30
  Delivery Subsystem.....18           Functional Purpose Level Taxa.31
                          --continued--
```

```
                                                              Page 3
TABLE OF CONTENTS (continued)
  Human-Machine System.....33         Measurement Application.....44
  Learner.....34                      Measurement Purpose.....45
  Learning.....35                     Objectives-Level Taxa.....46
  Learning-Helping.....36             Performance Constraints.....48
  Levels of System Description.37     Performance Environment.....49
  Logistics Subsystem.....40          Performance Potentialities....50
  Measure.....42                      Performance Processes.....51
  Measurement.....43                  Performance Products.....52
                          --continued--
```

Page 4

TABLE OF CONTENTS (continued)

Page 5

ANALYTIC PROCESS MODEL

The analytic process model is a conceptual framework for systematizing the design and evaluation of human-machine systems.

Stages of the Analytic Process Model include:

1: Establishing the design/evaluation context by identifying the system's work requirements (The Systems Taxonomy Model Stage)

2: Establishing the focus of the Design/Evaluation in terms of necessary system attributes

--continued--

Page 6

ANALYTIC PROCESS MODEL (continued)

3: Implementing the application details to design/evaluate the attributes

4: Interpreting the outcome of the design/evaluation and developing conclusions and recommendations

See Also:

Systems Taxonomy Model.....58
Design.....20
Evaluation.....29

Page 7

APM

See Analytic Process Model....5

Page 8

ASPECTS OF PERFORMANCE

The aspects of human-machine system performance form one dimension for organizing the system's work requirements. The aspects of performance address the work itself and the circumstances under which the work is required.

Aspects of performance include five mutually exclusive categories:

1. Performance Potentialities (inherent capabilities)
2. Performance Processes (activities, methods, techniques)
3. Performance Products (goods, services, other deliverables)
4. Performance Environment (natural impediments to the work)

--continued--

Page 9

ASPECTS OF PERFORMANCE (continued)

5. Performance Constraints (man-made, artificial impediments)

The aspects of performance form one dimension of the System's Taxonomy Model. They interact with another dimension, viz, levels of system description, to form fifteen cells or sub-taxonomies within which any system's work requirements can be exhaustively identified and organized.

See also: Systems Taxonomy Model.....58
Levels of System Description....37
Performance Potentialities..50
Performance Processes.....51
Performance Products.....52
Performance Environment.....49
Performance Constraints.....48

Page 10

ATTRIBUTE

An attribute of a human-machine system is a concrete, observable feature of the system that bears directly on the work that the system can and does perform. Attributes are linked to specific taxa of performance. For each performance taxon, there exists a set of system attributes that collectively determine whether the system satisfies that taxon.

A system attribute is something that a system designer can and must control, through design decisions, to insure that the system will satisfy the performance taxon to which the attribute is linked. An attribute also is

--continued--

Page 11

ATTRIBUTE (continued)

something that an evaluator can and must measure to determine whether the performance taxon is met.

See also:
Taxon.....61
Measure.....42
Design Specification.....21

Page 12

CHARACTERISTICS LEVEL TAXA

Characteristics-level taxa are statements of how a specific purpose behind a system's work is required to be achieved. Characteristics-level taxa define the particular ingredients, methods and milestones that the system is to include in its work in order to satisfy its reasons for working.

A characteristics-level taxon is linked to or descends from a particular functional purposes-level taxon. The characteristics-level taxon defines a detailed capability, ingredient, procedural step, or intermediate output necessary to achieve a particular purpose behind some basic potentiality,

--continued--

Page 13

CHARACTERISTICS LEVEL TAXA (continued)

process or product. Characteristics-level taxa also include definitions of the relevant environmental and constraining factors that may interfere with the system's ability to provide these capability ingredients, carry out these procedural steps, or deliver these intermediate outputs.

Characteristics-level taxa consist of the system's performance potentialities, processes, products, environment and constraints viewed at the bottom-most level of system description. It is a view of work requirements as things that are to be achieved in certain ways.

--continued--

Page 14

CHARACTERISTICS LEVEL TAXA (continued)

See also:

Taxon.....61
Objectives-level taxa.....46
Functional purposes-level taxa.....32
Levels of system description.....37
Aspects of performance.....8

Page 15

COLLATERAL SYSTEM

A collateral system of a particular human-machine system of interest is itself a human-machine system that interacts directly with the system of interest so that it effects the work required of the system of interest.

A collateral system may work either cooperatively or in competition with the system of interest.

Collateral systems are members of the system hierarchy of the system of interest.

See also:

Human-Machine System.....33 System Hierarchy.....57

Page 16

COMMAND SUBSYSTEM

The Command Subsystem is one of the six generic, functionally-oriented subsystems of any training system. Command provides administrative control over the training system by assessing training needs; allocating resources; recruiting training system personnel; and monitoring, evaluating and recording learner and system performance.

Command contributes to the learning--helping function by constructing and managing the system in which the learning activities can take place.

--continued--

Page 17

COMMAND SUBSYSTEM (continued)

The principal operator or staff member of the command subsystem is the training administrator.

see also: Training System.....63
Learning.....35
Learning-Helping.....36

Page 18

DELIVERY SUBSYSTEM

The Delivery Subsystem is one of the six generic, functionally-oriented subsystems of any training system. Delivery is the most important training subsystem, in that the primary training fuction (learning) takes place there. In the Delivery Subsystem, the prescribed sensory learning activities are carried out and the learner achieves the intended behavioral effects.

The principal operator of the Delivery Subsystem is the learner. The learner is assisted in Delivery by all other training system personnel, who play various learning-helping roles.

--continued--

Page 19

DELIVERY SUBSYSTEM (continued)

see also: Training System.....63
Learner.....34
Learning.....35
Learning-Helping.....36

Page 20

DESIGN

Usage No. 1 (Principal Definition): One of two Applications of the Analytic Process Model. Design of a human-machine system is the process of selecting and securing all of the attributes that the system must possess in order to satisfy its work requirements.

See also: Analytic Process Model.....5
Design Specification.....21
Evaluation.....29

Usage No. 2 (Secondary Definition): One of six Generic Subsystems of any Training System. Synonym: DESIGN SUBSYSTEM

Page 21

DESIGN SPECIFICATION

A design specification is a plan for insuring that a system will have some particular required attribute.

A design specification describes how the system will be built, maintained and operated so that a specific attribute needed to satisfy a particular performance requirement or taxon will be present.

see also: Attribute.....10
Taxon.....61
Measure.....42

--continued--

Page 22

DESIGN SUBSYSTEM

The Design Subsystem is one of the six generic, functionally-oriented subsystems of any training system. Design carries out the development of the curriculum/program of instruction. In so doing, Design plans the instructional events; selects training technology; assembles content material; and defines facilitator and learner requirements.

The Design Subsystem is the portion of the Training System in which the Instructional System Development (ISD) model is applied.

--continued--

Page 23

DESIGN SUBSYSTEM (continued)

Design Subsystem contributes to the learning-helping function by identifying the specific behavioral effects needed by the learners and by planning the sensory activities that will lead to those effects.

The principal operator of the Design Subsystem is the curriculum developer.

see also: Training System.....63
Instructional System Design.....??
Learning.....35
Learning-Helping.....36

Page 24

EMPLACEMENT SUBSYSTEM

The Emplacement Subsystem is one of the six generic, functionally-oriented subsystems of any training system. Emplacement takes the plans developed by Design Subsystem and constructs, acquires or assembles all materials, equipment, installations, supplies, etc., needed to implement those plans.

Emplacement contributes to the learning-helping function by providing the tools needed to carry out the sensory learning activities.

--continued--

Page 25

EMPLACEMENT SUBSYSTEM (continued)

The principal operator of the Emplacement Subsystem is the facilities developer.

see also: Training System.....63
Design Subsystem.....22
Learning.....35
Learning-Helping.....36

Page 26

ENABLING SUBSYSTEM

The Enabling Subsystem is one of the six generic, functionally-oriented subsystems of any training system. Enabling is itself a self-contained training system: it carries out learning and learning-helping activities to enable facilitators to (1) become familiar with the plans, training content, equipment and facilities provided by the DESIGN and EMPLACEMENT Subsystems; (2) become qualified and prepared to teach the curriculum effectively; and, (3) tailor the curriculum to the specific needs of a particular class or team of learners.

--continued--

Page 27

ENABLING SUBSYSTEM (continued)

Within the total training system, Enabling contributes to the learning-helping function by providing personnel qualified to assist the learners directly by presenting information, demonstrating techniques, coaching learners' efforts, evaluating learners' performance, and correcting learners' deficiencies. Enabling also contributes to learning-helping by fine-tuning a general program of instruction to specific learning needs of specific l learners.

The principal operator of the Enabling Subsystem is the facilitator.

--continued--

Page 28

ENABLING SUBSYSTEM (continued)

Common synonyms for Enabling Subsystem are 'Instructor Preparation' and 'Training-the-Trainer.'

see also: Training System.....63
Design Subsystem.....22
Emplacement Subsystem.....24
Facilitator.....30
Learning.....35
Learning-Helping.....36

Page 29

EVALUATION

Evaluation is one of two applications of the Analytic Process Model. Evaluation of a human-machine system is the process of determining whether the system satisfies all of its work requirements. Synonym: Measurement

see also: Analytic Process Model.....1
Measure.....42
Design.....20

Page 30

FACILITATOR

A facilitator is a key learning-helper in a training system, and is the principal operator of the training Enabling Subsystem.

The facilitator interacts directly with the learner to aid the learner in carrying out planned sensory activities to achieve desired behavioral effects.

Common synonyms for 'facilitator' include 'Teacher,' 'Instructor' an 'Trainer.'

see also: Learning-Helping..36 Training System..63 Enabling Subsystem..25
Delivery Subsystem18 Learner.....34

Page 31

FUNCTIONAL PURPOSES-LEVEL TAXA

Functional Purposes-level taxa are statements of why specific performance is required of a system, without reference to how the requirement is to be achieved.

A Functional Purpose level taxon is linked to or descends from particular objectives level taxon. The Functional Purposes-level taxon defines a specific reason why the system is expected to posess a particular basic capability, or carry out a basic activity, or deliver a basic output.

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FUNCTIONAL PURPOSES-LEVEL TAXA (continued)

Funtional purposes-level taxa also include definitions of the relevant environmental and constraining factors that may impede satisfaction of the reasons behind the system's work requirement.

Functional Purposes-level taxa consist of the system's performance potentialities, processes, products, environment and constraints viewed at the middle level of system description. It is a view of work requirements as things that exist for specific purposes, the achievement of which merits study.

See also: Taxon..61 Objectives-Level Taxa..46 Charact.-level taxa..12
Levels of System Description.....37 Aspects of Performance8

HUMAN-MACHINE SYSTEM

'Human-machine system' is an undefined term representing the entity of interest to the Analytic Process Model.

A naive description of the concept is as follows:

A Human-machine system is a collection of people, equipment, and procedures that work together to accomplish specified functions.

LEARNER

A Learner is the key operator of a training system, and the principal oper operator of the training Delivery subsystem. The learner is the person who carries out and experinces planned sensory activities to achieve intended behavioral effects.

Common synonyms for 'learner' include 'student' and 'trainee.'

See also:
Learning.....35 Training System.....63
Delivery Subsystem..18 Facilitator.....30

LEARNING

Learning is any activity involving the senses that effects behavior.

Learning is the principal function of a training system.

In a training system, desired human behavioral effects are achieved through the conduct of planned human sensory activities.

See also:
Learner.....34 Learning-Helping.....36 Training System.....63

Page 36

LEARNING-HELPING

Learning-Helping is the secondary, supportive function of a training system.

Learning-helping is any activity undertaken to provide an efficient learning environment for the learners.

All training system personnel contribute to the learning-helping function.

See also:

Learning.....35
Training System.....63

Page 37

LEVELS OF SYSTEM DESCRIPTION

The levels of human-machine system description form one dimension for organizing the system's work requirements. The levels of description address the work itself, why the work is required, and how its requirements are to be met.

The levels of system descriptions include three hierarchically-related categories:

1. Objectives level (what work is required and what impediments the work faces)

--continued--

Page 38

LEVELS OF SYSTEM DESCRIPTION (continued)

2. Functional Purposes Level (why each objectives level requirement exists, and the impediments that apply to satisfy each purpose).
3. Characteristics Level (how each functional purpose level requirement will be met, and the impediments that apply to carrying out each step).

The levels of system description form one dimension of the Systems Taxonomy Model. They interact with another dimension, viz, aspects of performance, to form fifteen cells or sub-taxonomies within which any system's work requirements can be exaustively identified and organized.

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Page 39

LEVELS OF SYSTEM DESCRIPTION (continued)

See also:

Systems Taxonomy Model....58
Objectives-Level Taxa.....46
Characteristics-Level Taxa12
Aspects of Performance.....8
Functional Purposes-Level Taxa32

Page 40

LOGISTICS SUBSYSTEM

The Logistics Subsystem is one of the six generic, functionally-oriented subsystems of any training system. Logistics subsystem deals with maintenance of facilities and equipment; housing, feeding and recreation of training system personnel; replenishment of consumables, transportation of people and materials; general housekeeping; etc.

Logistics contributes to the learning-helping function by attending the myriad of details necessary to keep the training system running smoothly and free of discomfort/distraction.

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Page 41

LOGISTICS SUBSYSTEM (continued)

The principal operator or staff member of the Logistics Subsystem is the Logistic supporter.

See also:
Training system..63 Learning..35 Learning-Helping..36

Page 42

MEASURE

A measure is a judgment or appraisal of some attribute of a system. A measure is a test or assessment of whether the attribute is 'good enough' to meet the demands of the Performance requirement or taxon to which the attribute is linked.

Every measure contributes an important bit of information about the system's satisfaction of the performance taxon of interest.

See also:
Attribute..10 Taxon..61 Design Specification..21

Page 43

MEASUREMENT

see: Evaluation.....29

Page 44

MEASUREMENT APPLICATION
See: Measurement Purpose.....45

Page 45

MEASUREMENT PURPOSE
The measurement purpose for a particular application of the Analytic Process Model to some system is the specific work of that system that is to be evaluated in the application.
A measurement purpose defines a particular sub-taxonomy of system performance requirements for which measures are to be selected and applied. Synonym: Measurement Application
See also: Taxonomy.....62
Measure.....42

Page 46

OBJECTIVES-LEVEL TAXA
Objectives-level taxa are statements of what performance is required of a system, without reference to why the performance is required or how it is required to be performed.
Objectives-level taxa include definitions of the basic capabilities, activities and outputs expected of the system and of the relevant environmental and constraining factorss that apply to those basic capabilities, activities and outputs.

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Page 47

OBJECTIVES-LEVEL TAXA (continued)
Objectives-level taxa consist of the system's performance potentialities, processes, products, environment and constraints viewed at the topmost level of system description. It is a view of work requirements as objects for study in and of themselves.
see also: Taxon.....61
Functional Purposes-Level Taxa.....32
Characteristics-Level Taxa.....12
Levels of System Description.....37
Aspects of Performance.....8

PERFORMANCE CONSTRAINTS

A system's performance constraints are the artificially-imposed factors governing the circumstances and situations of the system's operation that may affect whether and how the system satisfies its work requirements.

Constraints include all man-made impediments to the system's potential, process or product performance.

See also: Aspects of Performance.....8
Performance Environment.....49
Performance Potentialities...50
Performance Processes.....51
Performance Products.....52
Levels of System Description.37

PERFORMANCE ENVIRONMENT

A system's performance environment is the set of naturally-occurring factors associated with or incidental to the circumstances and situations of the system's operation that may affect the system's satisfaction of its work requirements.

The environment includes all natural impediments to the system's potential, process, or product performance.

See also: Aspects of Performance.....49
Performance Constraints.....48
Performance Potentialities..50
Performance Processes.....51
Performance Products.....52
Levels of System Description..37

PERFORMANCE POTENTIALITIES

A system's performance potentialities are those taxa of required performance that *define the basic, inherent capabilities* that the system is to possess.

see also: Taxon.....61
Performance Processes.....51
Performance Products.....52
Aspects of Performance.....8
Levels of System Description.37

PERFORMANCE PROCESSES

A system's performance processes are those taxa of required performance that define the activities the system is to carry out, or the methods/techniques the system is to employ.

see also: Taxon.....61
Performance Potentialities....50
Performance Products.....52
Aspects of Performance.....8
Levels of System Description..37

Page 52

PERFORMANCE PRODUCTS

A system's performance products are those taxa of required performance that define the goods, services or other output that the system is to deliver.

see also: Taxon.....61
Performance Potentialities....50
Performance Processes.....51
Aspects of Performance.....8
Levels of System Description..37

Page 53

STM

See: Systems Taxonomy Model.....58

Page 54

SUBSYSTEM

A subsystem of a particular human-machine system of interest is itself a human-machine system that is subservient to the system of interest in the work it performs. Subsystems may be totally contained within the system of interest. Subsystems are members of the system hierarchy of the system of interest.

See also:
Human-Machine System.....33
System Hierarchy.....57

Page 55

SUPRASYSTEM

A suprasystem of a particular human-machine system of interest is itself a human-machine system to which the system of interest is subservient in the work it performs.

The system of iterest may be totally contained within the suprasystem.

Suprasystems are members of the system hierarchy of the system of interest.

See also:
Human-machine system.....33
System Hierarchy.....57

SYSTEM

See: Human-Machine System.....33

SYSTEM HIERARCHY

The system hierarchy surrounding a particular human-machine system of interest is the network of other systems with which the system of interest interacts in the performance of its work.

System Hierarchy is one dimension of the Systems Taxonomy Model.

See also:

SYSTEMS TAXONOMY MODEL

The systems taxonomy model is a conceptual framework and a set of analytic procedures for identifying the performance requirements (or taxa) associated with a system of interest.

The Systems Taxonomy Model is the first stage of the Analytic Process Model.

The Systems Taxonomy Model identifies and organizes the performance taxa of a system of interest along three dimensions:

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SYSTEMS TAXONOMY MODEL (continued)

1) System Hierarchy -- This dimension insures that work requirements will be identified by studying the system of interest itself, as well as by studying the work requirements imposed upon the system of interest by other, interacting systems that are linked to it hierarchically.

2) Aspects of Performance -- This dimension insures that the identified work requirements will include not only what the system is to produce, but also the processes it is to carry out, the capabilities it is to possess, and the circumstances under which it is to operate.

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SYSTEMS TAXONOMY MODEL (continued)

3) Levels of System Description -- This dimension insures that the work requirements will be identified not only in terms of what is expected, but also why it is needed and how it is supposed to be accomplished.

Synonym: STM.....53

See also:

Analytic Process Model.....5
Taxonomy.....62
Levels of System Description.37
Taxon.....61
Aspects of Performance....8
System Hierarchy.....57

TAXON

A particular category or class pertaining to some thing or concept of interest.

A taxon is an element of a taxonomy.

A system performance taxon is a particular type or category of performance that is required of a system of interest.

See also:

Taxonomy.....62
Aspects of Performance.....8
Systems Taxonomy Model.....58
Levels of System Description.37

TAXONOMY

Proper noun:

The science or technique of classification, as in the technique of classifying and organizing the performance requirements of a human-machine system.

Common Noun:

A particular classification of things or concepts, as in a classification and organization of a particular system's performance requirements.

See also:

Taxon.....61
Systems Taxonomy Model.....58

TRAINING SYSTEM

A training system is a particular type of human-machine system, intended to accomplish two major functions: Learning and Learning-Helping.

Training Systems have six types of operators, or staff members:

Learners	Facilitators	Administrators
Curriculum Developers	Facilities Developers	Logistic Supporters

--continued--

Page 64

TRAINING SYSTEM (continued)

Training systems have six functionally-oriented subsystems, each of which is operated principally by one of the types of operators:

Command (training administrator)	Design (curriculum developer)
Emplacement (facilities developer)	Logistics (logistic supporter)
Enabling (facilitator)	Delivery (learner)

See also:

Learning.....35	Learning-Helping.....36	Command Subsystem.....16
Design Subsystem..22	Emplacement Subsystem.24	Logistics Subsystem....40
Enabling Subsystem25	Delivery Subsystem....18	Human-Machine Subsystem33

Page 65

SUMMARY
(conclusion)

I hope that my help file (glossary) has been very helpful to you. If you didn't find what you were looking for, please see the Analytic Process Model Final Report for more information.

Sincerely,

Your Friendly APM System

To view other help entries, please type in entry number (e.g., 1 return)

VI. EQUIPMENT, SUPPLIES AND DISKS REQUIRED TO USE THE APM DEMONSTRATION PACKAGE

A. Equipment

1. Apple II Plus Computer with:
   1. Pascal capability
   2. Eighty (not forty) column display VIDEX board

2. Computer monitor--a standard computer monitor, but not a TV monitor (VIDEX will not work with TV monitor).

3. Disk Drives--two standard Apple II disk drives

4. Datasouth Printer Model DS-180 and appropriate serial or parallel interface (required only if printout is requested).

5. Electrical extension cords, as required to reach from equipment to wall outlet.

B. Supplies

1. 11 x 8½ inch computer paper with sprocket holes

2. Spare disks for standard Apple II Plus disk drives

C. Program Disks Required (11) initially

1. BOOT System contains computer code (unreadable to humans)
   a. SYSTEM.STARTUP--a program which tells the Apple you wish to use the APM system
   b. GREETING (little version) simply reminds the analyst to insert the APM System Disk to continue
   c. SYSTEM.APPLE--initializes Apple for Pascal

2. APMSYS contains computer code (unreadable to humans)
   a. GREETING performs the following operations--
      1). presents the TITLE PAGE
      2). presents INSTRUCTIONS (if the analyst wants them)
      3). asks the analyst which system class he/she plans to use and shows the analyst how to create new system classes
      4). asks the analyst which SYSTEM and SUBSYSTEM he/she plans to use (and allows the analyst to create new ones)
      5). presents the analyst with a list of ANALYTIC PROCEDURES available and asks what he/she wants to do next.
   b. PERFormance ITEM allows the analyst to edit the list of performance items (objectives, functional purposes and characteristics), adding items, rewording items, deleting items and printing out items available.
   c. MEASATTR allows the analyst to edit MEASures and ATTRibutes for each performance item, adding, rewording and deleting as appropriate.

d. MEASPURP allows the analyst to edit MEASurement PURPoses (adding, rewording and deleting as appropriate). It also allows the analyst to associate or disassociate measurement purposes with characteristics. (As characteristics are associated and disassociated, the associated objectives and functional purposes are also. Thus, these operations are never done directly.)
e. PRINT allows the analyst to print either 1) all performance items, attributes and measures, or 2) performance items, attributes and measures for a given measurement purpose. The analyst may choose to print only some objectives, functional purposes and characteristics in this program without altering the basic data set.
f. PACK--a program which causes the Apple to pack the APMSYSTEM data sets more efficiently.
g. SYSTEM.LIBRARY--a version of the Apple Pascal Library.

3. APMUTL
   a. INSTRUCT--the instruction set which is displayed at the beginning of a session (Warning: to avoid garbled copy, do not attempt to print out this data set by using any procedure other than responding Yes to the question [Would you like to print the instructions]? which appears immediately after the instructions are displayed in the APM session!
   b. HELP--contains the 10 line help commands which are displayed during a session (Warning: to avoid garbled copy, do not attempt to print this file except by responding Yes to the question [Would you like to print the help commands?]
   c. APMSYSTEM--a file created the first time GREETING is run. The file contains the names of all of the systems available.
   d. Up to 10 other files--one for each system class which contains at least one system (Note: all system classes which have been used contain at least one system.) The name of each of these files will be the first five letters of the system name.
   e. Up to 10 files for each system which contains at least one subsystem (Note: all systems which have been used contain at least one subsystem.) The name of each of these files will be the first five letters of the system name.
   f. Extra Space--contains many blocks of unused space which are used for a temporary file while executing the pack procedure. (Warning: do not attempt to use this space for anything! If you do, the pack program may not work properly.)

4. APMPG1* contains the source code for:
   a. GREETING
   b. PERFITEM

5. APMPG2* contains the source code for:
   a. MEASATTR
   b. MEASPURP

6. APMPG3* contains the source code for:
   a. STARTUP
   b. GREETSHORT
   c. PRINT
   d. PACK

7. APMPG4* contains the source code for:
   a. HELP
   b. BRIEFHELP
   c. INSTRUCT
   d. BLOCKINSTR
   e. BLOCKHELP

8. Apple1 contains the machine-readable code for:
   a. BLOCKINSTR
   b. BLOCKHELP

*APMPG1, APMPG2, APMPG3 and APMPG4 contain source code which may be read using the editor, compiled using the compiler which is present on these disks, or transferred using the Transfer procedure in the Pascal Files Program (explained in the Pascal Operating System Reference Manual). To perform these compilations, place Apple1 in drive #1 and the APMPG# disk in drive #2. Compiled object code may be transferred to the APMSYSTEM disk using the Transfer procedure in the Apple Files Program.

9. TRBRDE: contains all data for the Design subsystem of the BIFV Training System
   a. TRABRADESFI--contains the performance items (objectives, functional purposes and characteristics)
   b. TRABRADESCO--contains an index to the performance item file
   c. TRABRADESAT--contains the Attributes list
   d. TRABRADESAC--contains an index to the Attributes list
   e. TRABRADESME--contains the Measures list
   f. TRABRADESMC--contains an index to the Measures list
   g. TRABRADESIS--contains the Measurement Purposes and associated indexes
   h. TRABRADESFA--when it exists, enables the print program to execute rapidly

**It is deleted each time the PACK procedures are performed, emptied when MEASPURP is run, and is created each time PRINT is performed using a measurement purpose other than Global.

10. TRBREN--contains all data for the Enabling subsystem of the Bradley Fighting Vehicle training system. The file names are composed once again using the first three letters of the system class system and subsystem names and the same suffixes used on the TRBREN disk. Thus, it contains the following files:

a. TRABRAENAFI
b. TRABRAENACO
c. TRABRAENAAT
d. TRABRAENAAC
e. TRABRAENAME
f. TRABRAENAMC
g. TRABRAENAIS
h. TRABRAENAFA

11. TRBRDE: contains all data for the delivery subsystem of the BRADLEY Fighting Vehicle Training System. The file names are composed in the same manner as they were for the other data bases.

12. ....other disks for other systems and/or other subsystems. All will be in the exact same format.

VII. SCHEMATIC FLOW CHARTS OF THE APM DEMONSTRATION PACKAGE

The basic APM demonstration package is comprised of six independent programs. Although many procedures are common to more than one program, each program is completely self-contained so that it can be compiled independently. A brief schematic flowchart of the six independent programs follows in Figures 2 through 7. Figure 2 shows the logic underlying the GREETING program, the program which allows the analyst to select a system class, system and subsystem. The GREETING program also instructs the analyst and provides him/her with the opportunity to select which of the remaining programs he/she wishes to use.

The PERFITEM program (Figure 3) enables the analyst to examine performance items (objectives, functional purpose and characteristics level taxa). The MEASATTR program (Figure 4) enables the analyst to examine attributes and measures. The MEASPURP program (Figure 5) enables the analyst to define measurement purposes or reasons for performing the analysis. The PRINT program (Figure 6) prints out the performance items, attributes and measures for either a single measurement purpose, or the global measurement purpose (which consists of all performance items in the subsystem of interest). The PACK procedure (Figure 7) organizes the performance item, attribute and measure files into numeric order so that they may be accessed more readily. It also removes any excess space which may be in the files so that additional data can be added to the files.

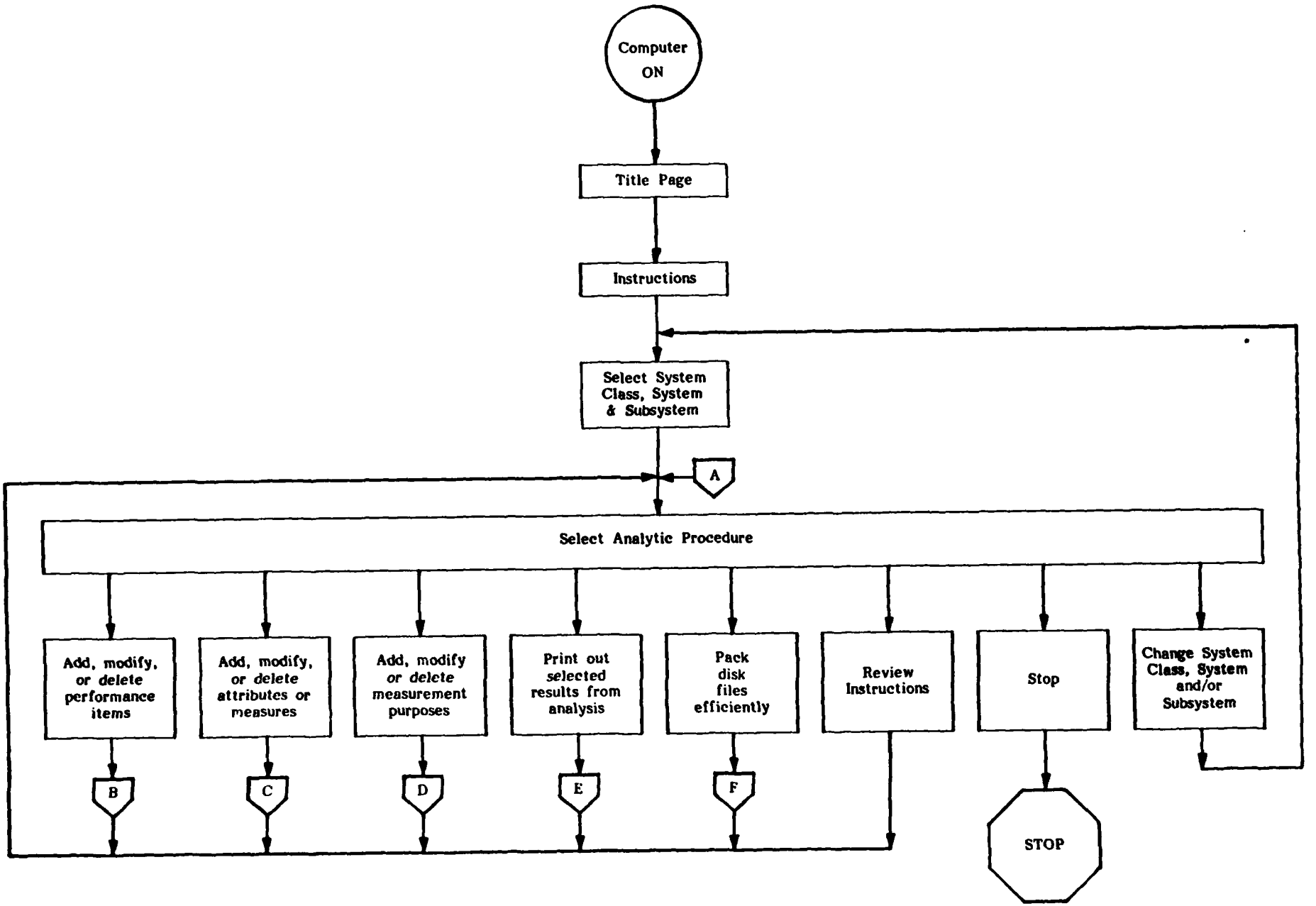

Figure 2. Simplified Flow Chart for Greeting Program

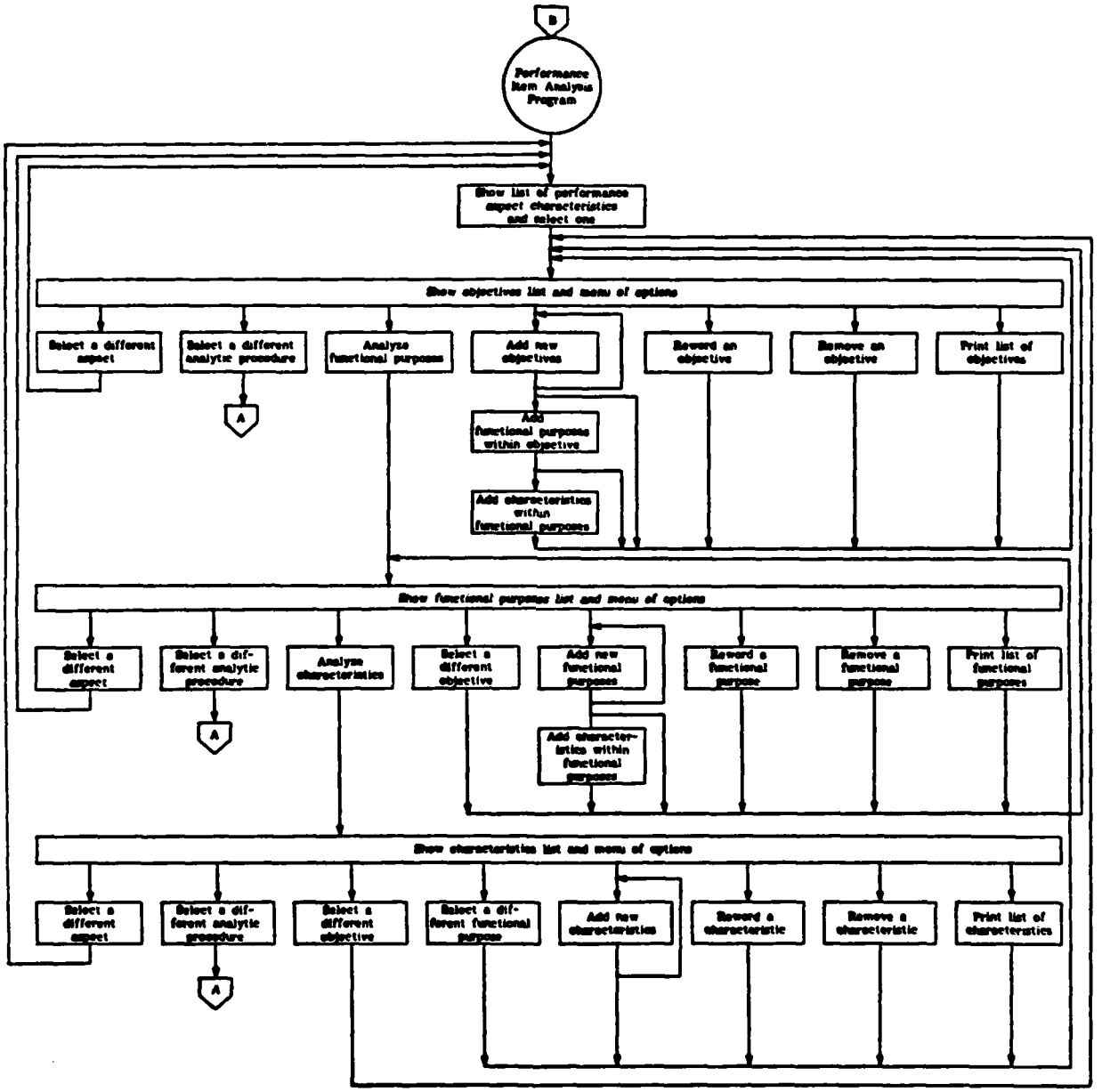

Figure 3. Simplified Flow Chart for Performance Item Program

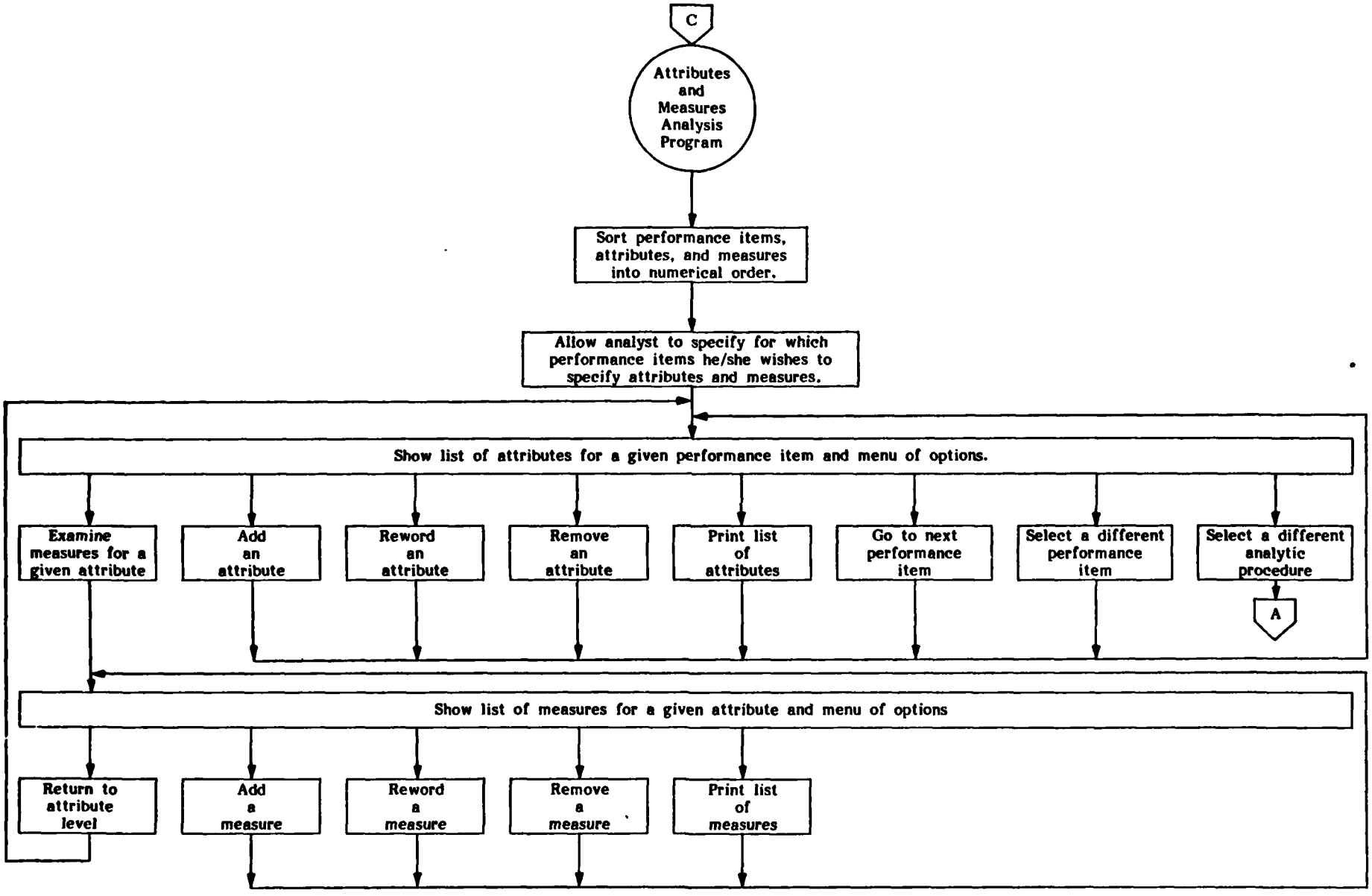

Figure 4. Simplified Flow Chart for Attributes and Measures Program

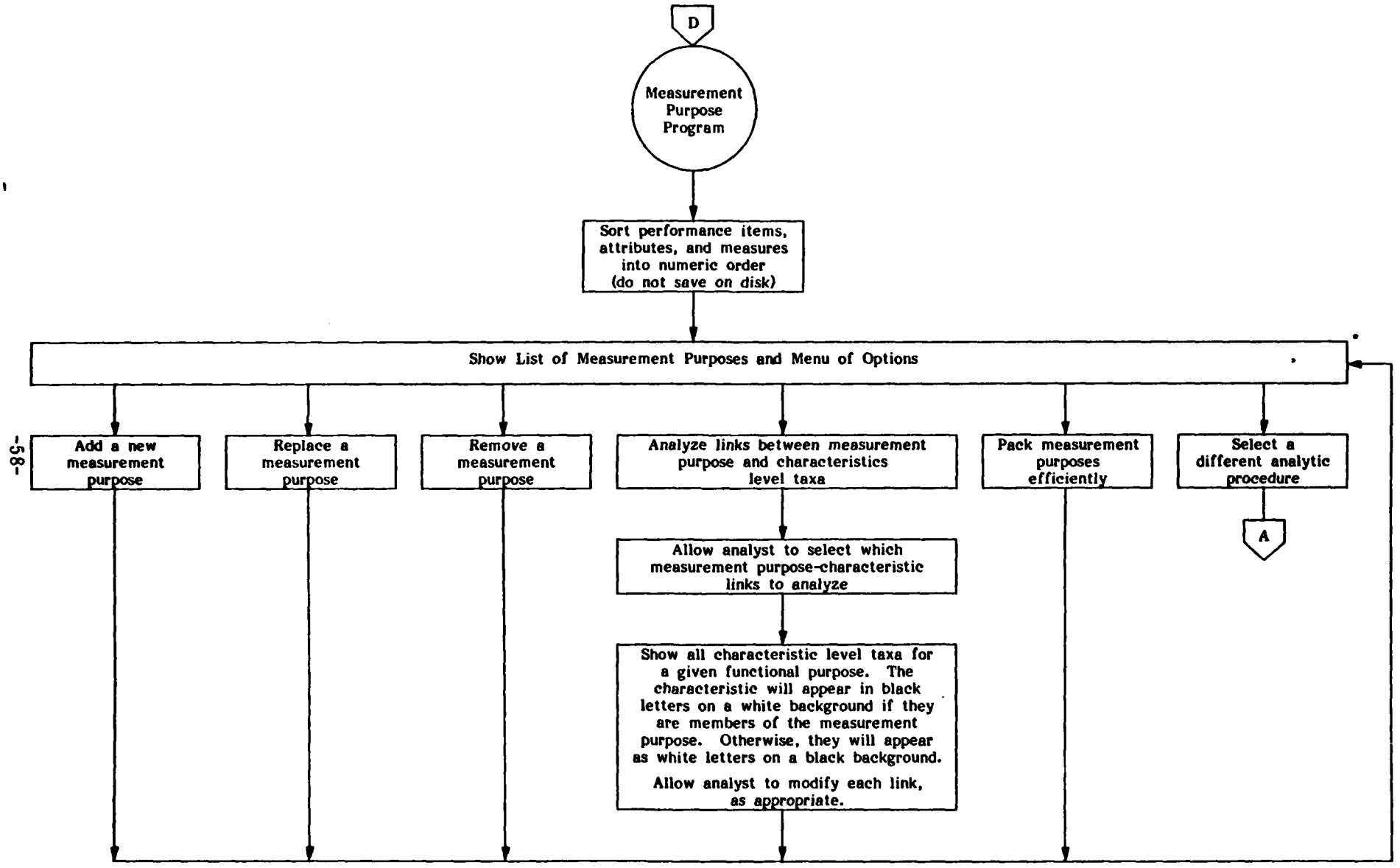

Figure 5. Simplified Flow Chart for Measurement Purpose Program

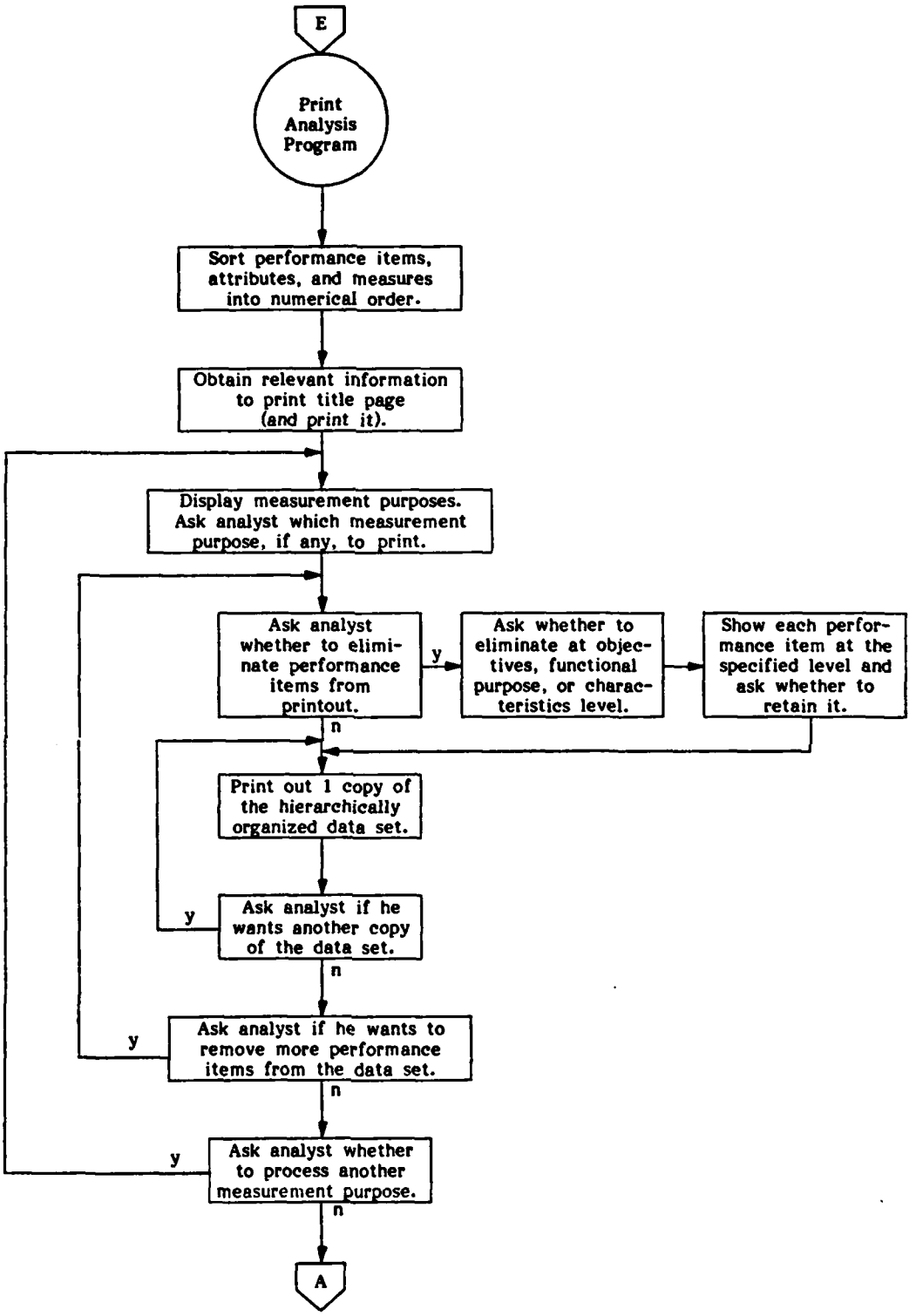

Figure 6. Simplified Flow Chart for Print Program

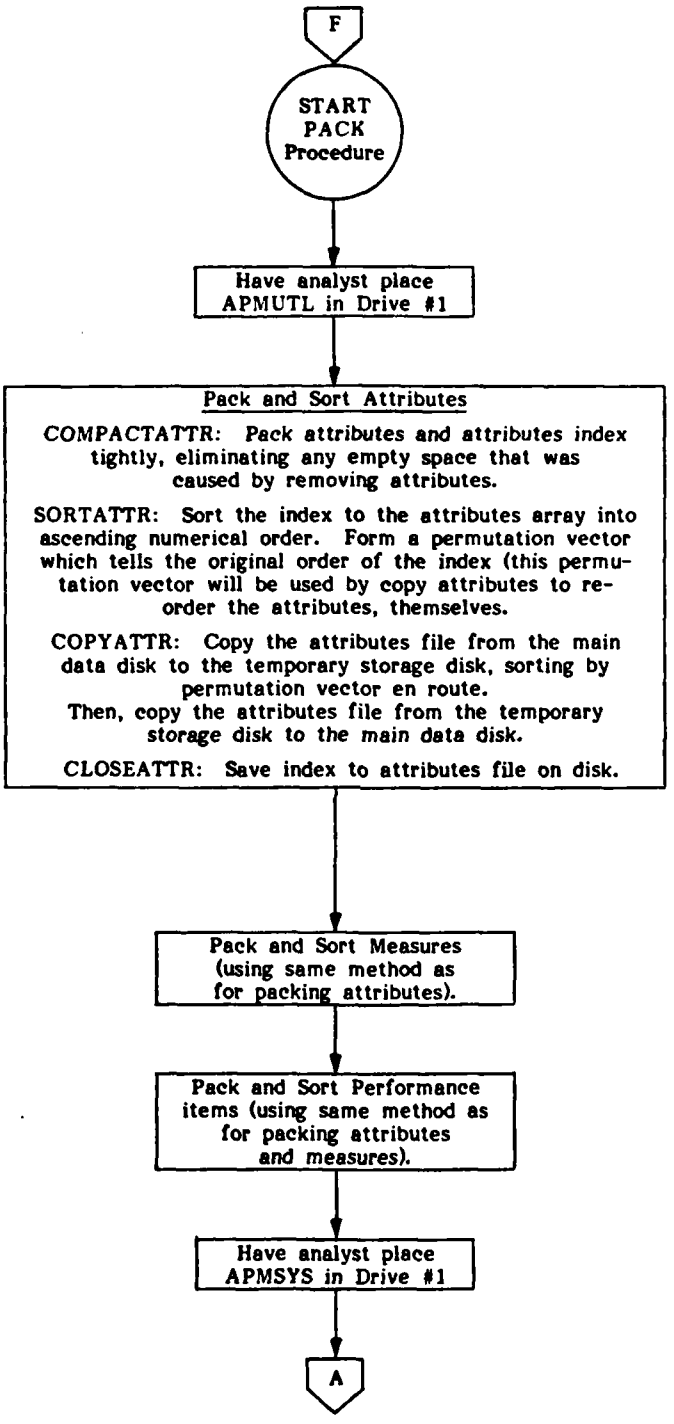

Figure 7. Simplified Flow Chart for Pack Program